Global Population Shifts and Impacting Factors: A Series of Data Visualizations

Project by: Assiba Lea Apovo, Cassidy Cruz, Widchy Joachim, Daniel Pineda, and Edward Tabije

Background

Fertility rates and population growth/decline are critical indicators of demographic trends that shape societies worldwide. As nations navigate economic, social, and environmental challenges, these rates have varied significantly, reflecting cultural norms, access to healthcare, global events, and government policies. Our project aims to visualize global population trends over the last 60 years with the goal of identifying factors which impact the generally perceived downward trend in overall population. We aim to highlight some of the realities of the current population demographics to provide some sense of what the future may hold for the world.

Source

- For our analysis, we primarily used the dataset “World Development Indicators” provided by the World Bank Group, available publicly on their Databank website
- We chose this dataset since it utilized the most robust set of variables and indicators and aligned closely with our visualization goals

Resources & Programming Dependencies

Project Hosting: Streamlit Community Cloud

Our aim was to make our project readily available and straightforward to access and use. Streamlit's community cloud allows us to host our working project without the need for the downloading of files or complicated installations. We can just simply direct any potential users to a url and our project is there to view and interact with immediately.

Base Language: Python

Python's capabilities already make it an effective tool to conduct data analysis. This is further elevated by the numerous libraries that we utilized for this project:

- pandas
- streamlit
- google-cloud-bigquery v. 3.26.0
- google-auth-httplib2 v. 0.2.0
- folium v. 0.18.0
- requests v. 2.32.3
- streamlit_folium v. 0.23.1
- plotly-express v. 0.4.1

Resources & Programming Dependencies

Database: Big Query

We opted to use BigQuery due to the following reasons:

- World Bank already loaded the data into BigQuery as a public dataset that was already pre-cleaned
- In the absence of a database on a shared local/private network, a cloud-based database service allowed each member of our group to access that same dataset which decreased the chances of introducing errors
- The Google Cloud API allows us to query data from our BigQuery database directly from our Python program, which reduces the chance of introducing errors while also saving on local file storage
- Integrating BigQuery into our workflow was much more seamless since we were already using other tools/services within the Google Suite for organizing and planning

Indicators

1.) Age Dependency Ratio (% of the population): The ratio of dependents--people younger than 15 or older than 64--to the working-age population--those ages being 15-64. Data are shown as the proportion of dependents per 100 working-age population.

Indicators

2.) Age Dependency Ratio, Young and Old (% of the population):

Young Dependents: Typically defined as individuals aged 0-14. This group relies heavily on the working-age population for support.

Old Dependents: Generally includes individuals aged 65 and older. This group may require care and resources from the working population, often due to retirement or health issues.

Indicators

3.) The Human Capital Index (HCI) is a measure developed by the World Bank to assess the potential productivity of a country's future workforce. It evaluates the health, education, and skills of individuals, aiming to quantify how well countries are investing in their human capital.

The HCI takes into account several factors, including:

- Survival Rate
- Schooling
- Quality of Education
- Health

The index provides a score ranging from 0 to 1, where higher values indicate better human capital outcomes.

Indicators

4.) Fertility rate, total (births per woman):

Total fertility rate represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with age-specific fertility rates of the specified year.

5.) Net Migration:

The net total of migrants during the period, that is, the number of immigrants minus the number of emigrants, including both citizens and noncitizens.

Indicators

6.) Labor Force, total:

Labor force is comprised of people ages 15 and older who supply labor for the production of goods and services during a specified period.

It includes people who are currently employed and people who are unemployed but seeking work as well as first-time job-seekers.

Indicators

7.) GNI per capita, Atlus Method (adjusted to USD):

This is the gross national income, converted to U.S. dollars using the World Bank Atlas method, divided by the midyear population.

Supplementary Metrics

- For the Streamlit visualization, we included additional indicators for the user to interact with and compare between various country metrics
- Such indicators include metrics such as mortality rates, urban population, total population, life expectancy, and gender proportionality

Conclusions

- We see a general downward trend in population rates among most countries but there are several indicators which reveal different causes and impacts
- HCI data shows that countries like Luxembourg, Switzerland, and South Korea are experiencing declines, while Zimbabwe, Egypt, and India are seeing gradual growth.
- China makes an interesting case study, as fertility rates drop from 1.7 in 1981 to 1.4 in 2023, yet their GNI per capita and HCI experience a slow, but study rise

Conclusions

- In general, we are seeing countries adjust to the changing population trends by investing increasing improvements to overall health, education, and technology to supplement this shift from the last 40 years
- Net migration plays a role in the elasticity of labor force population shifts between developing and developed nations but our findings are inconclusive in this respect due to the limitations of the dataset
- Overall, the fears of seismic disruptions to the global economy due to a dwindling population seem unsubstantiated based off of the numbers analyzed for this project

The end!